



Riparian Habitats

Climate Change Vulnerability, Adaptation Strategies, and Management Implications in Southern California National Forests



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Habitat Description

Southern California riparian habitats vary widely with regard to species composition, geomorphology, and hydrologic regimes. For the purposes of this assessment, discussion will be limited to vernal pools, springs, and wet meadows. These categories include both precipitation- and groundwater-dominated systems, and they are frequently characterized by a high water table, periodic flooding, hydric and/or mesic vegetation, and the presence of rare, endemic, and threatened or endangered species adapted to these habitat types.

Habitat Vulnerability

Sensitivity & Exposure

Riparian habitats are critically sensitive to changes in the amount, source, and duration of water within a system, and habitats that rely solely on precipitation are most sensitive to changes in the amount or timing of rain and snow. Drought conditions have widespread effects on all system types, and may shift species composition towards vegetation that can tolerate drier conditions. Severe flooding can cause erosion and channel entrenchment that may alter habitat structure and function, and wildfire greatly increases the risk of flash flooding and debris flows. Climate vulnerabilities in riparian habitats are further exacerbated by habitat degradation or loss due to anthropogenic stressors.

Moderate Vulnerability



Drivers of Riparian Habitats

- Climate sensitivities: precipitation, snowpack depth, timing of snowmelt/runoff, soil moisture, low stream flows, drought
- Disturbance regimes: Wildfire, flooding
- Non-climate sensitivities: dams and water diversions, invasive species, land use conversion

Projected Climate and Climate-Driven Changes	Potential Impacts on Low-Gradient Riparian Habitats
Changes in precipitation and drought <i>Variable annual precipitation volume and seasonal pattern; longer, more severe droughts with drought years twice as likely to occur</i>	<ul style="list-style-type: none"> • Changes in water quality and/or chemistry • Altered timing and duration of inundation in vernal pools • Reduced spring discharge rate • Extirpation of aquatic species where pools dry up
Decreased snowpack and earlier timing of snowmelt and peak runoff <i>Up to 50% reduction in snowfall and 70% reduction in snowpack by 2100 (greatest loss in low elevations); snowmelt and peak runoff occurring 1-3 weeks earlier</i>	<ul style="list-style-type: none"> • Delayed or reduced groundwater recharge • Compositional shift towards xeric vegetation • Losses or compositional shifts in species that depend on spring flooding and/or cold-water habitat created by snowmelt
Altered stream flows <i>More extreme low flows and increased duration of low- or no-flow conditions; altered frequency and/or severity of flooding; 30-40% increase in flash floods in small river/stream basins</i>	<ul style="list-style-type: none"> • Compositional shifts towards xeric vegetation and associated bank erosion and channel incision in meadows • Decreased stream connectivity, affecting aquatic species • Loss of salmonids due to increased water temperature • Decreased amphibian reproduction where habitat declines

Adaptive Capacity

Factors that enhance adaptive capacity:

- + Disturbance-adapted community with diverse species composition
- + High structural, spatial, and functional diversity
- + Cool, wet conditions can provide refugia under changing climate conditions
- + Provides key ecosystem services: water supply, flood/erosion protection, and sediment transport

Factors that undermine adaptive capacity:

- Large areas of habitat have already been lost or heavily impacted, and may not be able to recover without management intervention
- Fragmentation and upstream barriers reduce habitat connectivity and species dispersal
- Increasing water demand from urban communities may threaten springs and other sources

Adaptation Strategies for Riparian Habitats



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What kinds of adaptation options are there?

- Enhance Resistance* → Prevent climate change from affecting a resource
- Promote Resilience* → Help resources weather climate change impacts by avoiding the effects of or recovering from changes
- Facilitate Transition* → Accommodate change and/or enable resources to adaptively respond to variable conditions
- Increase Knowledge* → Gather information about climate impacts and/or management effectiveness in addressing climate change challenges
- Engage Collaboration* → Coordinate efforts and capacity across landscapes and agencies

Adaptation Category	Adaptation Strategy	Specific Management Actions
Enhance Resistance	Preserve native riparian habitat and maintain habitat connectivity	<ul style="list-style-type: none"> • Establish wilderness areas, focusing on intact riparian habitat • Use vegetation to increase shading of riparian habitat and maintain cool, wet areas¹
	Manage grazing to reduce impact on riparian habitat	<ul style="list-style-type: none"> • Build livestock enclosures to protect riparian habitats that are easily damaged by grazing² • Implement moderate grazing around vernal pools to maintain vernal pool hydrology²
Promote Resilience	Identify and restore key ecosystem functions	<ul style="list-style-type: none"> • Restore floodplain function by establishing setbacks, stabilizing banks and headcuts, and employing plug-and-pond techniques to support current and future hydrology
	Increase habitat heterogeneity to support species diversity	<ul style="list-style-type: none"> • Enhance breeding sites by providing microhabitat structure (e.g., woody debris) for nesting and egg deposition
Facilitate Transition	Support species' survival under changing conditions	<ul style="list-style-type: none"> • Focus amphibian conservation activities in areas identified as climate refugia and/or areas that may be suitable habitat in the future
Increase Knowledge	Prioritize the protection of riparian habitat and monitor the effects of changing climate conditions	<ul style="list-style-type: none"> • Rank the vulnerability of groundwater-dependent systems • Map riparian habitat, climate trends and 50-year climate projections, surrounding native vegetation, and historical species ranges
Engage Collaboration	Improve overall watershed health	<ul style="list-style-type: none"> • Develop partnerships with university programs that focus on hydrology, groundwater, and/or watersheds • Incorporate boardwalks and educational features to offer the public information about watershed health

*Actions presented are those evaluated as having higher effectiveness and/or feasibility.

Management Implications

This information can be used in a variety of ways:

- ✓ Forest Plan Revisions
- ✓ U.S. Forest Service Climate Change Performance Scorecard: Element 6 - "Assessing Vulnerability" and Element 7 - "Adaptation Actions"
- ✓ Bureau of Land Management Resource Management Plan Revisions

Resilient management requires implementing a variety of adaptation options



Further information and citations can be found in source reports, *Climate Change Vulnerability Assessment for Focal Habitats of Southern California* and *Climate Change Adaptation Strategies for Focal Habitats of Southern California*, available online at the EcoAdapt Library: <http://ecoadapt.org/library>.

¹ Halofsky, J. E., Peterson, D. L., O'Halloran, K. A., & Hawkins Hoffman, C. (Eds.). (2011). *Adapting to climate change at Olympic National Forest and Olympic National Park* (No. Gen. Tech. Rep. PNW-GTR-844). Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

² Pyke, C. R., and J. Marty. (2005). Cattle grazing mediates climate change impacts on ephemeral wetlands. *Conservation Biology* 19:1619–1625.